Winemaking enzymes

Acceleration – Clarification – Liberation

IOC
Révélons votre différence
Clarifying musts

Pre-fermentation grape sediments may contain undesirable compounds, such as oxidating enzymes from the grapes, Botrytis or oils that give rise to herbaceous flavours. More generally, in excess, these are responsible for a loss of finesse and aromatic intensity since they affect the yeast’s metabolism. It is therefore necessary to act quickly to avoid minor quality variations arising from the fermentation of insufficiently clarified musts and to preserve aromatic sharpness, and also to facilitate subsequent racking off and filtration.

Various enzymes, such as the pectinases that work on pectins and the beta- (1,3-1,6)-glucanases that break down glucans (polysaccharides from Botrytis cinerea), make the musts less viscous and therefore sensibly accelerate the sedimentation of particles.

Clarification: The criteria for choosing enzymes

- **GRAPE AFFECTED BY BOTRYTIS**
  - Restoring aromatic sharpness and freshness
  - INOZYME CLEAR
- **DECANTING**
  - Normal conditions
  - INOZYME
  - Ease of use
  - INOZYME LIQUIDE
  - Difficult conditions
  - INOZYME TERROIR
- **FLOTATION**
  - Facilitating attachment of particles
  - FLOTAZYMEx
- **THERMOVINIFICATION**
  - Powerful activity suited to juices rich in particles
  - INOZYME TERROIR
  - Ease of use
  - INOZYME LIQUIDE
Maceration and extraction

During extraction, pectinase activities are supported by secondary activities (cellulase and hemicellulase) that help to weaken the cells in the grapes’ pulp and skin, thus releasing otherwise inaccessible juice and, more importantly, certain components attached to the solid matter, such as tannins, pigments, certain polysaccharides and even aromatic precursors.

Generally speaking, the quality of the juices extracted will be improved (better stabilised components, less compounds extracted by trituration, more free-run wine and less polyphenols in white wine musts) and the work required is simplified: drawing off / returning and grape treading are easier with red wines whilst gentler pressing may be used with white and rosé wines.

Some of our specific and original preparations go even further, since they enable glycosidase activities that can transform precursors into active aromas.

Our winemaking enzymes have also been selected in such a way as to meet every product difficulty and/or objective effectively.

Red wine maceration and extraction: The criteria for choosing enzymes

- GRAPE WITH HIGH POTENTIAL
  - Colour stabilisation
  - Volume in the mouth / structure
  - Early clarification and racking off

- GRAPES WITH AVERAGE POTENTIAL
  - Extraction of colour / tannins from the skins
  - More free-run wine
  - Normal conditions
  - Straightforward conditions
  - Easy to use
  - Avoids trituration and/or difficult conditions

- COLD PRE-FERMENTATION MACERATION
  - Active at low temperatures

- ROUND AND FRUITY WINES
  - Amplification of aromas
  - Roundness in the mouth

White/rose wine maceration and extraction: The criteria for choosing enzymes

- VINS ROSÉS FRUITÉS
  - Amplification of aromas
  - Roundness in the mouth

- EXTRACTION DE JUS AU PRESSURAGE
  - More pressing wine
  - Early clarification of musts

- MACÉRATION PELLICULAIRE OU SUR BOURBES
  - Immediate extraction and revelations of aromas
  - Limitation of polyphenols
  - Aromatic intensity
  - Powerful extraction of aromatic precursors
  - More pressing wine
  - Limitation of polyphenols
  - Aromatic freshness
Certain key factors affect all enzymatic activities in various ways:

• Low temperatures slow down the enzymes, whilst excessively high temperatures (>60-70°C) destroy them.
• The lower the pH, the more the activity is inhibited.
• The longer the contact time, the more time the enzyme has to migrate from one molecule to another and the more it will be able to hydrolyse the molecules.
• The greater the quantity of enzymes, the greater the quantity of molecules that can be ‘attacked’ simultaneously.

For any given process, it may not always be possible to adjust the first three factors in order for the enzyme formula to achieve its full potential. It is often necessary, therefore, to match the quantity of enzymes to the physical or temporal constraints.

Ageing and stabilisation

In the wine, a large number of aromatic precursors (terpenes, C13-norisoprenoids) can still be revealed by means of various glycosidase activities, of which the most important are the beta-glucosidases.

The yeast lees also have much to offer. They contain many interesting components such as fruity esters, polysaccharides associated with increased roundness and peptides able to amplify sugariness or aromas, etc. This is where the synergy takes place between the pectinases and beta-(1,3;1,6)-glucanases, which accelerate the autolysis of the yeasts and allow the transfer of these active elements to the wine.

These synergic pectinase/glucanase activities are also involved in the stabilisation of wine by racking. In essence, they improve clarification and filterability, which are generally complicated by the presence of macromolecules from the grapes and the yeast.

Lastly, it is possible to control the development of undesirable lactic bacteria by the use of lysozyme.

Stabilisation and ageing: The criteria for choosing enzymes

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Winemaking enzymes: from the grape to the wine...

What is a winemaking enzyme?
An enzyme is a protein, a catalyst for accelerating natural reactions. Every living organism functions as a result of enzymatic activity. The function of enzymes is related to the presence, in their structure, of an active site to which molecules attach themselves and can then be transformed more quickly. In winemaking, this transformation generally takes the form of the breakdown of a molecule into smaller compounds with physical, chemical or sensorial properties that are radically different from those of the parent molecule.

In winemaking, what is it that the enzymes act upon?
The wall of a grape’s cells is made up of very large and strongly branched molecules, all tangled together. These are polysaccharides, mainly consisting of a wide variety of pectins but also celluloses and hemi-celluloses.

In addition to those of the grape itself, other polysaccharides may be involved in winemaking, such as the beta-(1,3-1,6)-glucans resulting from the autolysis of yeasts and infection by Botrytis. Grape polysaccharides significantly slow down the dispersion of important grape harvest components such as free-run wine, pigments, tannin and aromatic precursors through the must. Polysaccharides in the must or wine are responsible for a significant degree of viscosity, preventing the rapid sedimentation of particles and decreasing the subsequent filterability of the wine.

Lastly, certain wine aromas remain as odourless precursors since they are attached to certain molecules, such as glucose, that cause them to lose their volatility.

Winemaking enzymes accelerate hydrolysis reactions for all of these compounds by breaking them down into much smaller fragments. In practice, the linkages are destroyed, which allows the sedimentation of heavier particles and the release of a grape’s important compounds. The aromas are then released and become odorant.

The many advantages of using enzymatic preparations
- Quantitative improvements: overall juice content, free-run wine, fractions derived from gentle pressing, compaction of the lees.
- Qualitative improvements of the juices: less triſuration due to physical extraction procedures, better extraction of important compounds.
- Less effort needed for extraction (shorter pressings, easier drawing off and returning to the barrel).
- Time savings.
- Reduced sensorial risks thanks to quicker sedimentation of various undesirable compounds such as:
  • Oxidating enzymes in the suspension,
  • Certain oils in the suspension that could be transformed into undesirable aromas by the yeast,
  • Micro-organisms affecting the must and the wine.

Diagram showing a section through a grape
What is enzyme 'activity'? Can I compare activities between preparations from different suppliers?

The 'activity' of an enzyme is a measurement of its ability to accelerate hydrolysis on a given substrate, e.g., a pectic compound. There are, however, various methods and units of measure for enzymatic activities, which often make it difficult to compare one preparation with that from another supplier. Lastly, the notion of 'activity' itself remains, in any case, inadequate as a means of measuring the performance of any enzymatic formula since it is the synergy across all the activities of a given preparation within a real must that plays the determinant role, and not the individual activities regarded separately within a model environment.

Is there any interaction between a selected enzymatic preparation and other winemaking products?

In this regard, the main proven inhibitor of enzymatic activity is bentonite, so this should only be used after having achieved the required results or else thoroughly eliminated before adding any enzymes. SO2 can, theoretically, inhibit enzyme activity but only at levels significantly greater than those used with wine. The tannins present in wine, such as winemaking tannins, do not cause any inhibition of pectolytic enzymes in the quantities used but they are, however, likely to limit quite strongly the activity of any beta-glucanases after several days. Gelatine and silica gels do not inhibit enzymatic preparations but, for greater effect, they should only be used after the enzyme activity is complete.

When should I add the enzyme? With white wines, should I add enzymes in the wine-press basket or in the settling tank?

The enzyme should be added as soon as possible during the process in order to make the most of the enzymatic activity as early as possible and for as long as possible. It is thus generally preferable to add the enzyme in the receiving hopper, i.e., before the wine press, in order to increase the extraction of the juice and aroma precursors during pressing. In addition, this will help to initiate the hydrolysis of pectins to assist in the settling process. It is even possible, sometimes, to decrease the amount of clarification enzymes added for settling, or even eliminate them altogether.

How do I calculate the amount of pectins in order to find the quantity of enzymes to use?

The pectin test (procedure available on request) is quick and easy to do and establishes whether a must still contains pectins or not. It therefore allows one to adjust the quantity of enzymes required to ensure good clarification. This being so, experience and practice allow us also to recommend the right quantities based on various known factors, as shown in our data sheets. Similarly, there is also a glucan test suitable for assessing Botrytis-affected grape harvests.

Are there any precautions to take when using enzymes?

Enzymes are proteins and, for this reason, may have an allergic effect on susceptible individuals. Our solid enzymes are in granular form, which considerably reduces the risks from contact or inhalation. In spite of this, it is advisable to wear gloves when handling these products. At the same time, the proper make up of solutions and full homogenisation of the resultant dilution in the must or wine are essential in order to obtain the best results. We strongly recommend the use of metering pumps, drip systems or other diffusion systems (spraying, etc).

During clarification, can I add enzymes at an temperature (16-18°C) to help the activity and lower the temperature after a few hours in order to protect the must from starting alcoholic fermentation and to improve sedimentation?

This is tempting but risky; time spent, however briefly, at a high temperature will reduce the growth rate of micro-organisms. Even if one were to chill them afterwards, and even though part of the yeasts are still mixed in with the sediment, there is still a high risk of alcoholic fermentation starting on the sediments, possibly involving poor quality yeasts. Where such a process happens by accident rather than design, it is better to increase the quantity of enzymes and minimise the time spent on the sediments as much as possible.

How can I know when the enzyme has had its maximum effect during pre-fermentation? How long should I leave it to act?

Rather than adapt the period of pre-fermentation maceration to the enzymatic activity, you should adapt the quantity of enzymes to your time constraints. In essence, the maceration time before fermentation starts is going to depend on the fermentability of the grape harvest and the temperature at which it is kept. Our data sheets will help you choose the right quantity of enzymes based on the time during which you are able, or wish, to keep the maceration from fermenting in such a way that the enzyme provides its maximum extraction performance throughout this important stage.

Is it true that enzymes should not be added to a Botrytis-affected red grape harvest?

No. Where a grape harvest has been affected by Botrytis, it is essential to avoid any mechanical trituration of the grapes. On the other hand, enzymes do not affect the area under the skin affected by the Botrytis. When added to the mash, a maceration enzyme shows itself to be the instrument of choice to increase the diffusion of the pigments that is so necessary with Botrytis infections, without any of the risks arising from mechanical operations!